Title:

Network analysis to asses the productivity and resilience of complex agro-ecosystems

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Abstract: (Your abstract must use **Normal style** and must fit in this box. Your abstract should be no longer than 300 words. The box will 'expand' over 2 pages as you add text/diagrams into it.)

Mature ecosystems are characterised by recurrent patterns of material and energy flows, intense recycling within the system and relatively little dependence from the exterior. Their resilience and productivity are sustained on (i) their diversity of flow pathways that allows buffering external shocks, and (ii) the increased efficiency of few of their flow paths that are not affected by external stressors. This study is built on analogies between natural ecosystems and food production systems, or agro-ecosystems (i.e., systems in which humans - socially and/or politically related - use resources to make a living and re-invest to ensure their future). Within agro-ecosystems, humans use resources that are available far beyond the physical boundaries of the ecosystem, by making use of different types of flows, including information (flows), negotiation and (cross-scale) links with other systems. Very often such flows are 'hidden' in our analysis of farming systems, but they may be essential to sustainable food production in resource-constrained systems. Network analysis (NA) is proposed as a methodology to assess productivity and resilience of agro-ecosystems. With NA, the structure of a system is made explicit by a number of indices of system functioning: flow size, diversification, integration, connectivity and stability. Critical nodes in the organization of agro-ecosystems can be identified. Using examples from smallholder system in Africa, NA is applied at farm and community scales to analyse current strategies in the use of communally-owned resources. Through human agency, signals are sensed and management adapted by modifying flow pathways. Identifying critical nodes in current systems helps in designing more productive and resilient food production systems, and targeting policy interventions.